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मानक

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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 692 (1994): Paper insulated lead-sheathed cables for rated voltage up to and including 33 kv specification [ETD 9: Power Cables]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

33 किलो तक की रेटिड वोल्टता के लिए कागज-रोधी सीसा
चढ़े केबल — विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

PAPER INSULATED LEAD SHEATHED
CABLES FOR RATED VOLTAGE UP TO
AND INCLUDING 33 kV — SPECIFICATION

(Third Revision)

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

**AMENDMENT NO. 1 FEBRUARY 2004
TO
IS 692 : 1994 PAPER INSULATED LEAD SHEATHED
CABLES FOR RATED VOLTAGE UP TO AND
INCLUDING 33 kV — SPECIFICATION**

(Third Revision)

[Page 1, clause 3.1(c), line 2] — Substitute 'an' for 'and'.

(Page 2, clause 7, line 1) — Substitute 'interstices' for 'interstitches'.

(Page 2, clause 8, line 4) — Substitute 'copper wires. When applied in cables, it shall' for 'copper wires, when applied in cables, it shall'.

(Page 3, clause 13.1, line 1) — Substitute 'bedding' for 'beddin'.

(Page 3, clause 13.1, line 10) — Substitute 'when the' for 'whent he'.

(Page 3, clause 14) — Substitute the following for the existing:

'14 PVC COMPOUND

PVC compound for extruded bedding or serving shall comply with the requirement

of IS 5831 : 1984.'

(Page 3, clause 16.1, line 4) — Insert the word 'applied' in between the words 'be' and 'helically'.

(Page 4, clause 16.2, line 1) — Substitute 'above, and 3-core screened and SL cables' for 'above, and 3-core and 3-core SL cables'.

(Page 4, clause 16.2.1, line 1) — Substitute '6.35/11 kV' for '6.35 kV'.

(Page 4, clause 18.1, line 2) — Substitute '17' for '16'.

(Page 4, clause 18.1, line 3) — Substitute 'interstices' for 'interstitches'.

(Page 4, clause 18.2, line 2) — Insert 'and 17' between '16' and 'shall'.

(Page 4, clause 18.2, line 3) — Substitute 'interstices' for 'interstitches'.

(Page 4, clause 18.3, line 5) — Substitute 'interstices' for 'interstitches'.

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(Page 5, clause 21.2.1.2, line 3) — Substitute 'or' for 'of'.

(Page 5, clause 21.2.2, line 4) — Delete the words 'and lapped'.

[Page 5, clause 21.2.2(c)] — Substitute the following for the existing:

'c) One layer of impregnated paper and one layer of impregnated textile material, both being compounded.'

(Page 5, clause 21.3.1) — Substitute the following for the existing:

'21.3.1 When an extruded bedding is applied over a lead sheath, it shall be preferably black.'

(Page 5, clause 22.1.2, last line) — Substitute 'wire/strip' for 'wire strip'.

(Page 6, clause 23.2) — Substitute the following for the existing:

'23.2 Extruded Outer Sheath for Unarmoured or Armoured Cables

This shall be preferably black.'

(Page 6, clause 23.2.1, line 7) — Insert the words '(ts) by more than 0.2 ts' in between 'value' and '+ 0.2 mm'.

(Page 6, clause 23.2.1.1) — Delete the clause number '23.2.1.1' and retain the contents of this clause as second paragraph of 23.2.1.

[Page 6, clause 24.1(b), col 2] — Substitute 'IS 8130 : 1984' for 'IS 8130 : 1994'.

[Page 6, clause 24.1(j), col 2, line 2] — Substitute '23.2.1' for '23.3'.

[Page 6, clause 24.1(k)] — Substitute the following for the existing text:

'k) Test for physical properties of extruded PVC bedding and serving:

1)	Tensile strength and elongation at break	IS 5831:1984	Part 7 of IS 10810
2)	Loss of mass in air oven	do	Part 10 of IS 10810
3)	Shrinkage test	do	Part 12 of IS 10810
4)	Hot deformation test	do	Part 15 of IS 10810
5)	Ageing test	do	Part 11 of IS 10810
6)	Heat shock test	do	Part 14 of IS 10810
7)	Thermal stability test	do	Part 60 of IS 10810

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(Page 7, clause 24.6, line 1) — Substitute 'IS 10810 (Part 8) : 1984' for 'IS 10810 (Part 8) : 1964'.

(Page 7, clause 24.6, line 4) — Substitute '700 N/mm' for '700 N mm'.

(Page 7, clause 24.8.3, line 3) — Substitute 'the' for 'and'.

(Page 7, clause 24.8.3, line 4) — Substitute '(9.5 kV)' for '9.5 kV'.

(Page 8, Informal table under clause 24.8.3, col 3, heading, line 7) — Substitute '(9.5 kV)' for '9.5 kV'.

(Page 8, table under clause 24.9.2, col 4) — Substitute '17' for '25' and '25' for '17' against rated voltages '6.35/11' and '11/11' respectively under column 1.

(Page 8, clause 24.13) — Substitute the following for the existing clause:

'24.13 Bending Test for Finished Cables

24.13.1 The test shall be carried out in accordance with IS 10810 (Part 50) : 1984. The diameter of test cylinder shall not exceed the following:

Voltage Rating, kV	Single Core	Multi Core	
		Unarmoured	Armoured
Up to 11/11	20 D ¹⁾	15 D1)	12 D ¹⁾
12.7/22	25 D ¹⁾	20 D1)	15 D ¹⁾
19/33	30 D ¹⁾	25 D1)	20 D ¹⁾

¹⁾D = Observed dia of cable sample.

24.13.2 After the bending cycles have been completed the cable sample shall be subjected to the voltage test specified in 24.9.2 except that the test voltage shall be increased by 50 percent.

24.13.3 After this test, the sample shall be examined visually. The bending performance of the cable shall be deemed satisfactory when:

- a) the Cable sample withstands the applied voltage test without failure; and
- b) the Visual examination shows that the serving is free from splits, the armour is not noticeably displaced and the sheath is free from splits or cracks.'

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(*Page 9, clause 26.1, line 4*) — Substitute ' 4.0×0.8 mm' for ' 0.4×0.8 mm'.

(*Page 20, Table 18, col 10, row 13*) — Substitute '2.7' for '2.3' against the nominal cross section ' 500 mm^2 ' indicated under column 1.

(*Page 22, Table 20, col 2*) — Delete the words 'Between Conductors' from the heading.

(*Page 22, Table 20, col 3*) — Delete.

(*Page 29, Annex C*) — Substitute '*Clause 10*' for '*Clause 10.4*' in the clause reference given below Annex C.

(ET 09)

**AMENDMENT NO. 2 NOVEMBER 2007
TO
IS 692 : 1994 PAPER INSULATED LEAD-SHEATHED
CABLES FOR RATED VOLTAGES UP TO AND
INCLUDING 33 kV — SPECIFICATION**

(Third Revision)

[Page 3, clause 11.1(d)] — Substitute 'Galvanized Steel formed wire (strip), or' for 'Galvanized Steel strip, or'.

(Page 3, clause 11.2, line 2) — Substitute 'IS 3975 : 1999' for 'IS 3975 : 1988'.

(Page 6, clause 22.4) — Insert the following new clauses after 22.4:

“22.5 The dimensions of galvanized steel round wires/formed wires and galvanized/ungalvanized steel tapes shall be as specified in the relevant tables. The tolerance on nominal dimensions shall be as per IS 3975. However, for formed steel wires compliance shall be ensured only for dimensions 'A' & 'C'.

22.6 The round steel wires/formed steel wires taken from the cable shall meet the following requirements:

- a) The tensile strength of round steel wire/formed steel wire shall be not less than 250 N/mm^2 and not more 580 N/mm^2 .
- b) The Elongation at break of round steel wire/formed steel wire shall be not less than 6 percent.
- c) Round steel wire shall meet the requirements of torsion test. The gauge length between Vices and the minimum number of turns without break shall be as per Table 6 of IS 3975.
- e) The zinc coating shall not show any cracks and shall not flake off on rubbing by the bare finger when the formed steel wire is subjected to winding test.
- e) The uniformity of zinc coating of round steel wire/formed steel wire shall comply with the requirements of IS 3975 subject to the following:

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- The minimum number of dips shall be reduced by one half-minute dip
 - In case of formed wires, dip test is applicable only for the face
- f) The mass of zinc coating of round steel wire shall be not less than 95 percent of the mass specified in Table 2 of IS 4826. The mass of zinc coating of formed steel wire shall be not less than 95 percent of the mass specified in IS 3975.
- g) The resistivity of the round steel wire/formed steel wire shall meet the requirements of IS 3975.

22.7 The steel tapes taken from the cables shall comply with IS 3975 : 1999. However, the galvanized steel tapes shall withstand one dip of one and half minute for face instead of two dips of one minute and no dip test shall be required for edge."

[Page 6, clause 24.1, Sl No.(h)] — Substitute the following for the existing:

- h) Tests for steel wire/tape armour:
- | | | |
|---|-------------------|---------------------|
| 1) Dimensions | 22.5 of IS 692 | Part 36 of IS 10810 |
| 2) Physical tests on round/formed wire: | | |
| i) Tensile strength | 22.6(a) of IS 692 | Part 37 of IS 10810 |
| ii) Elongation at break | 22.6(b) of IS 692 | Part 37 of IS 10810 |
| iii) Torsion test for round wires | 22.6(c) of IS 692 | Part 38 of IS 10810 |
| iv) Winding test for formed wires | 22.6(d) of IS 692 | Part 39 of IS 10810 |
| v) Uniformity of zinc coating | 22.6(e) of IS 692 | Part 40 of IS 10810 |
| vi) Mass of zinc coating | 22.6(f) of IS 692 | Part 41 of IS 10810 |
| vii) Resistivity | 22.6(g) of IS 692 | Part 42 of IS 10810 |

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3) Physical tests on tape:

i) Tensile strength	22.7 of IS 692	Part 37 of IS 10810
ii) Elongation at break	22.7 of IS 692	Part 37 of IS 10810
iii) Uniformity of zinc coating*	22.7 of IS 692	Part 40 of IS 10810
iv) Mass of zinc coating*	22.7 of IS 692	Part 41 of IS 10810
v) Adhesion test*	22.7 of IS 692	IS 3975

**Applicable only for galvanized steel tapes.*

(Page 28) — Substitute the following for the existing entry:

'IS 3975 : 1999 Low carbon galvanized steel wires, formed wires and tapes
for armouring of cables — Specification'

(ET 09)

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(Continued on third cover)

Indian Standard

PAPER INSULATED LEAD SHEATHED CABLES FOR RATED VOLTAGE UP TO AND INCLUDING 33 kV — SPECIFICATION

(Third Revision)

SECTION 1 GENERAL

1 SCOPE

1.1 This standard specifies general requirements and construction for impregnated paper insulated, lead sheathed cables with copper or aluminium conductors having rated voltages from 0.65/1.1 kV to 19/33 kV.

1.2 Maximum Permissible Operating Temperature

The temperatures given in the table below are applicable to draining impregnation and non-draining impregnation and are intended as a guide, based on values widely used, for carrying out the tests:

Rated Voltages of Cables U_0/U	Highest Voltage for Equipment U_m	Maximum Per- missible Conti- nuous Conductor Temperature	
		Screened Cables	Belted Cables
kV	kV	°C	°C
0.65/1.1	1.2	—	80
1.9/3.3 and 3.3/3.3	3.6	—	80
3.8/6.6 and 6.6/6.6	7.2	—	80
6.35/11 and 11/11	12	70	65
12.7/22	24	65	—
19/33	36	65*	—

where

U_0 = rated power frequency voltage between conductor and screen or metallic sheath for which the cable is suitable,

U = rated power frequency voltage between phase conductors for which the cable is suitable, and

U_m = maximum sustained power frequency voltage between phase conductors for which the cable is suitable.

*For non-draining type cables only. The temperature for draining cables is under consideration.

1.3 The lead alloy sheathed wire armoured copper conductor cable of MIND type covered by this standard may also be used in mines, provided the combined conductance of the armour and lead alloy sheath, or in case when the purchaser so desires, the armour alone, shall be not less than 50 percent of the largest copper conductor contained in the cable, with a minimum of copper equivalent of 15 mm². To satisfy this, substitution of galvanized steel wire in armouring by required number of tinned copper wires is permissible.

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions in addition to those given in IS 1885 (Part 32) : 1971 shall apply.

3.1 Earthed System

An electric system which fulfils any of the following conditions:

- a) The neutral point or the mid-point connection is earthed in such a manner that, even under fault conditions, the maximum voltage that can occur between any conductor and the earth does not exceed 80 percent of the nominal system voltage;
- b) The neutral-point or the mid-point connection is not earthed but a protective device is installed which automatically cuts out any part of the system which accidentally becomes earthed; and
- c) In case of ac system only, the neutral point is earthed through and arc suppression coil with arrangements for isolation within one hour of occurrence of the fault for the non-radial field cables and within 8 hours for radial field cables, provided that the total of such periods in a year does not exceed 125 hours.

3.2 Unearthed System

An electric system which does not fulfil the requirements of the earthed system.

3.3 Dimensional Values (Thickness, Cross-Section, etc)

- a) *Nominal Values* — A nominal value is a value specified always in connection with a specified tolerance which has to be guaranteed by the manufacturer.
- b) *Approximate Values* — A value which is neither guaranteed nor checked, and is used, for example, for the calculation of other dimensional values.
- c) *Measured Values or Observed Values* — Values resulting from measurements or tests, carried out according to specified methods.

3.4 Type Tests

Tests required to be made before supply on a general commercial basis of a type of cable in order to demonstrate satisfactory performance characteristics to meet intended application.

NOTE — These tests are of such a nature that after they have been made, they need not be repeated unless changes are made in the cable materials or design which might change performance characteristics.

3.5 Acceptance Tests

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.6 Routine Tests

Tests made by the manufacturer on all finished cable lengths to demonstrate the integrity of the cable.

3.7 Optional Tests

Special tests to be carried out, when required, by agreement between the purchaser and the supplier.

SECTION 2 MATERIALS

4 CONDUCTOR

The conductor shall be composed of plain copper or aluminium wires complying with IS 8130 : 1984.

5 INSULATING PAPER

5.1 Paper used for cable insulation shall be uniform in texture and long fibred and shall not contain mechanical wood pulp or esparto. The chemicals used in pulping, bleaching or any other process of manufacture shall be removed. The paper shall be free from dark spots, imperfectly pulped materials, woody matter, lime spots, metallic particles and other deleterious

substances. It shall also be free from loading materials and from gelatine, albumen and resin size.

5.2 The paper shall have chemical characteristics as given in Annex B.

5.3 Thickness

The nominal thickness of individual paper tapes shall not exceed 0.15 mm for core insulation and 0.2 mm for belt insulation.

6 SCREENING MATERIALS

6.1 Carbon Paper

Semi-conducting carbon paper shall be similar to the insulating paper in composition and blended with finely dispersed carbon during its manufacture.

6.1.1 The nominal thickness shall be not less than 0.1 mm.

6.2 Metallic Tape

It shall be a non-ferrous metal tape made of either plain annealed copper or aluminium. The nominal thickness shall be not less than 0.06 mm.

6.3 Metallized Paper

It shall comprise aluminium foil bonded to insulating paper. It shall be perforated to enable mass impregnation of the cable. The thickness of such aluminium foil shall be not less than 0.01 mm.

7 WORMING MATERIALS

Worming materials for filling interstitches of twin and multicore cables shall comprise paper, cotton, jute or any other suitable materials. They shall not have any deleterious effect on other components of the cables.

8 COPPER WOVEN FABRIC TAPE

Copper woven fabric tape for use as binder over the laid up cores of screened cables shall comprise cotton tape incorporating interwoven copper wires, when applied in cables, it shall ensure electrical contact between core screens and metallic sheath.

9 INSULATING COMPOUND

9.1 The insulating compound for impregnation shall be such that the finished cable complies with the appropriate requirements of this standard.

9.2 The compound shall be either draining compound or 'non-draining compound'.

10 LEAD AND LEAD ALLOYS

The composition of lead and lead alloys for the metallic sheath of the cable shall comply with Annex C.

11 ARMOURING MATERIALS

11.1 Any one of the following armouring materials shall be used:

- Galvanized steel tape,
- Ungalvanized steel tape,
- Galvanized round steel wires,
- Galvanized steel strip, or
- Any non-magnetic material.

11.2 The armouring material covered by 11.1 (a) to 11.1 (d) shall comply with IS 3975 : 1988.

11.3 The specification for non-magnetic armouring material shall be as agreed between the purchaser and the manufacturer.

12 LAPPED BEDDING AND SERVING MATERIALS

12.1 The materials for lapped bedding and serving shall be as follows:

- Textile Materials* — Cotton, hessian, jute or any other synthetic material;
- Plastic Tapes* — Tapes of PVC, polyethylene or any other plastic material; and
- Paper* — It shall be free from pin-holes and has minimum thickness of 0.1 mm.

12.2 Before application on cable, all natural textile materials and paper shall be treated with protective compound.

13 PROTECTIVE COMPOUND

13.1 All protective compounds used for bedding and serving shall be derived from bitumen and shall be free from distillation products of coal and wood. They shall not have any deleterious effect on the lead or lead-alloy sheath, armour and bedding and serving materials. They shall be of such a nature that in the finished cable they do not crack or run at any temperature likely to be attained in transit to the site or on the site, before or after laying or when the cables are in operation.

13.2 The compound shall adhere properly to the armour and the lead or lead-alloy sheath, so that if coverings are unwrapped, it shall be evident that the metal surfaces were completely covered by closely adherent compound before removal of the wrapping.

14 PVC COMPOUND

PVC compound for extruded bedding or serving or both shall comply with the requirement of Type ST1 and ST2 of IS 5831 : 1984 as applicable.

SECTION 3 CONSTRUCTION

15 CONDUCTOR

15.1 The construction of the conductors shall be as follows:

Nominal Cross-Sectional Area	Solid/Stranded	Flexibility Class
Copper Aluminum		
mm ²	mm ²	
6	Up to 10	Solid/ Stranded
		Class 1 for solid Class 2 for stranded of IS 8130 : 1984
10 and above	16 and above	Stranded
		Class 2 of IS 8130 : 1984

15.2 The conductors of all twin-core, three-core and multi-core cables having their nominal cross section less than 25 mm² shall be circular only.

15.3 Cables with reduced neutral conductor shall comply with the main and neutral conductor combination given below:

Nominal Cross-Sectional of Main Conductor	Cross-Sectional Area of Reduced Neutral Conductor
mm ²	mm ²
25	16
35	16
50	25
70	35
95	50
120	70
150	70
185	95
240	120
300	150
400	185
500	240
630	300

16 SCREENING

16.1 Conductor Screening

All cables having rated voltage above 11 kV shall have a screen on each conductor consisting of two layers of semi-conducting carbon paper tape. The two layers shall be helically in the same direction and breaking joint.

16.2 Core Screening

Core screen shall be applied on single core cables having rated voltage of 6.35/11 kV and

above, and 3-core and 3-core SL cables of voltage rating 12/7/22 kV and 19/33 kV.

16.2.1 For 6/35 kV and 11/11 kV 3-core cables, the screen shall be applied on cores if screened type cable is required.

16.2.2 The screen shall be of a layer of non-ferrous metallic tape or perforated metallised paper.

NOTE -- Application of non-ferrous metallic tape without gap is not permissible.

17 CORE INSULATION

17.1 The conductor in accordance with 15.1 and 15.2 shall be helically lapped with tapes of insulating paper. When applied in the same direction, successive layers of paper shall break joint so as to form a reasonably smooth covering of uniform thickness.

17.2 Core Identification

17.2.1 All twin- and multi-core cables shall have the identified numbers printed on the outer layer of core insulation at frequent intervals. The dyes used for printing numbers shall not fade beyond recognition, and shall be chemically neutral and free from deleterious effect on paper.

17.2.2 Following numbers shall be used for core identification:

a) 0.65/1.1 kV cable

1) Twin-core cable	0	1	—	—
2) Three-core cable	0-1	2	3	—
3) Four-core cable	0	1	2	3

b) Three-core cables of 1.9/3.3 kV and higher voltages

NOTE — The numbers 1, 2 and 3 indicate the phase conductors and 0, the neutral conductor.

18 LAYING-UP OF CORES

18.1 Belted Cables

In twin and multi-core cables, the cores in accordance with 16 shall be laid up together with interstitches filled with worming material and covered with further layers of paper for belt insulation to form a reasonably compact and circular cable.

18.2 Screened Cables

In three-core screened cables, the screened cores in accordance with 16 shall be laid up together with interstitches filled with worming material, and further lapped with a binder of copper woven fabric tape.

18.3 Screened SL Cables

In screened SL cables, the screened cores mass-impregnated in accordance with 19 lead or lead alloy sheathed in accordance with 20 and bedded in accordance with 21 shall be laid up together with interstitches filled with compounded worming material and followed by one or more layers of textile material.

18.4 Direction of Laying Up

For all twin and multi-core cables the direction of laying up shall be right-hand.

19 IMPREGNATION

19.1 Insulation, paper-screens, fillers and binders tape (if any) shall be dried and impregnated with an insulating compound.

19.2 When specifically agreed to between the purchaser and the manufacturer, the cables impregnated with non-draining compound shall comply with the drainage test.

NOTE — Where the cables are to be installed on verticle runs or gradients, the use of non-draining compound is recommended.

19.3 Thickness of Insulation

The thickness of insulation excluding all screening materials shall not be less than the value specified in the relevant tables.

20 LEAD OR LEAD ALLOY SHEATH

20.1 After impregnation, the cable shall be covered with a metallic lead or lead alloy sheath as specifically agreed to between the purchaser and the manufacturer.

20.2 The sheath shall be extruded directly on the cable in the form of a seamless tube. It shall be reasonably close-fitting, impervious to moisture and free from pin-holes, joints, mended place and other defects. Stop-marks of the press are not considered as defects.

20.3 Thickness

The thickness of sheath shall not fall below the value specified in the relevant tables.

21 BEDDING

21.1 Armoured cable shall have a protective bedding over lead or lead alloy sheath.

21.2 Lapped Bedding

21.2.1 Except in SL cables, the bedding applied shall consist of suitably impregnated and compounded papers or a combination of two layers of impregnated and compounded paper followed by one or more layers of compounded fibrous material.

21.2.1.1 As an alternative to paper tapes, it shall be permissible to use plastic tapes.

21.2.1.2 The impregnation of bedding of natural textile material may be made with bituminous compound or other preservative material.

21.2.2 In SL cables, the bedding shall consist of bedding over each lead sheath followed by a covering layer over the laid up lead sheathed and lapped cores. The bedding over each lead sheath shall consist of one of the following:

- a) At least two layers of impregnated and compounded paper,
- b) 2-layers of plastic tape, or
- c) 1-layer of impregnated paper and layer of impregnated textile material, both being compounded.

21.2.2.1 The covering over the laid up cores shall consist of one or more layers of impregnated and compounded natural textile material.

21.2.2.2 The impregnation of bedding of natural textile material may be made with bituminous compound or other preservative material.

21.2.3 Thickness of Bedding

The total thickness of the protection between lead sheath and armour measured after application of the armouring should have the approximate value of 1.5 mm.

21.3 Extruded Bedding

21.3.1 When an extruded PVC bedding is applied over a lead sheath, it shall be preferably black and of type ST2 of IS 5831 : 1984.

21.3.2 Thickness

The thickness of extruded bedding shall not fall below the value specified in the relevant tables.

22 ARMOUR

22.1 Type of Armour

For cables having calculated diameter over lead or lead-alloy sheath up to and including 13 mm, the armour shall consist of galvanized round steel wires only. Where calculated diameter over lead or lead alloy sheath is more than 13 mm, the armour shall consist of galvanized round steel wires or galvanized steel strips or two layers of galvanized or ungalvanized steel tape.

22.1.1 In case of SL cables, the basis of selection of the type of armour shall apply to the calculated diameter over laid up cores.

22.1.2 Where armouring is required for single-core cables intended for use in ac system, it

shall consist of non-magnetic material and shall be as specifically agreed to between the purchaser and the manufacturer. In case of single-core cables intended for use in dc system, armouring shall be done by galvanized steel wire strip.

22.2 Application

22.2.1 Double Steel Tape Armour

22.2.1.1 When steel tapes are ungalvanized, they shall be thoroughly coated on both sides with protective compound before being applied to the cable.

22.2.1.2 The two layers of tape shall be laid helically with a left-hand lay so that outer tape is approximately central over the gaps of inner tape. The gap between the adjacent turns of each tape shall not exceed 50 percent of the tape width. The outer tape shall overlap the inner tape on both sides by not less than 15 percent of the tape width.

22.2.1.3 The nominal thickness of uncompound-
ed steel tape shall be as specified in the relevant tables.

22.2.2 Single Wire or Strip Armour

The armour shall consist of a single layer of galvanized steel wire or strip and shall be applied with left-hand lay. The nominal diameter of wire or dimensions of strip shall be as specified in the relevant table.

22.2.3 Double Wire or Strip Armour

22.2.3.1 The armour shall consist of two layers of galvanized steel wires or strips. The inner layer of wires or strips shall be applied with left-hand lay. The outer layer shall be applied with right-hand lay except in special cases when specifically agreed to between the purchaser and the manufacturer.

22.2.3.2 Separator

A separator consisting of a layer of compounded textile material shall be applied between the two layers of armour wires or strips.

22.2.3.3 For both layers, the nominal diameter of wires or dimensions of strips shall be the same as for single wire or strip armoured cable.

22.3 Binder Tape

A binder tape may be applied over flat steel wire armour, or if necessary, over round steel wire armour. It may be applied in the same direction as the armour or in the opposite direction.

22.3.1 It shall consist of galvanized steel tape having a nominal thickness of not less than 0.2 mm. The minimum thickness shall not

fall below the specified nominal value by more than 10 percent.

22.4 Joints

The joints in the armour/strips or tapes shall be made by brazing or welding and the surface irregularities shall be removed. A joint in any wire/strip or tape shall be at least 300 mm from the nearest joint in any other armour wire/strip or tape in the completed cable.

23 SERVING AND OVERALL SHEATH

23.1 Textile Serving on Armour

The serving having an approximate thickness of 2 mm shall consist of a suitable number of compounded layers of textile material. In order to prevent adhesion, a coating of white wash or suitable material shall be applied to the outside of the cable.

NOTE — The impregnation of textile serving may be made with either bituminous compounds or other preservative materials.

23.2 Extruded Outer Sheath for Unarmoured or Armoured Cables

This shall be black preferably and of type ST2 of IS 5831 : 1984.

23.2.1 Thickness

Where the sheath is applied over the lead sheath of an unarmoured cable, the average thickness determined by taking a number of measurements shall not be less than the value specified in the relevant tables and the smallest of the measured values shall not fall below the specified value + 0.2 mm. For this purpose, the calculated minimum permissible value shall be rounded off to an accuracy of 0.01 mm.

23.2.1.1 When the sheath is applied over armoured cables, the thickness shall not fall below the value specified in the relevant tables.

23.3 The thickness of extruded PVC serving shall not fall below the value specified in the relevant table.

NOTE — For embossed cables, the point at which the measurements made shall not coincide with any embossing.

SECTION 4 TESTS

24 CLASSIFICATION OF TESTS

24.1 Type Tests

The following shall constitute type tests:

	<i>For Requirements Refer to:</i>	<i>For Test Methods Refer to:</i>
a) Annealing test (for copper)	IS 8130 : 1984	Part 1 of IS 10810
b) Tensile test (for aluminium)	IS 8130 : 1994	Part 2 of IS 10810
c) Wrapping test (for aluminium)	do	Part 3 of IS 10810
d) Conductor resistance test	do	Part 5 of IS 10810
e) Test for thickness of insulation	19.3 of IS 692	24.5 of IS 692
f) Test for thickness of lead and lead alloy sheath	20.3 of IS 692	Part 34 of IS 10810
g) Breaking strength and elongation test for insulation	24.6 of IS 692	Part 8 of IS 10810
h) Test for thickness of steel tape or diameter of round steel wire or dimensions of flat steel strips	IS 3975 : 1988	Part 36 of IS 10810
j) Test for thickness of extruded PVC bedding and serving	21.3.2 and 23.3 of IS 692	Part 6 of IS 10810
k) Tests for physical properties of extruded PVC bedding and serving:		
1) Tensile strength and elongation at break	IS 5831 : 1984	Part 7 of IS 10810
2) Loss of mass in air oven		Part 10 of IS 10810
3) Shrinkage test		Part 12 of IS 10810
4) Hot deformation test		Part 15 of IS 10810
m) Impulse test	24.7 of IS 692	Part 47 of IS 10810
n) Dielectric power factor/voltage test (for 19/33 kV cables only)	24.8 of IS 692	Part 48 of IS 10810
p) High voltage test	24.9 of IS 692	Part 45 of IS 10810
q) Bending test for finished cables	24.13 of IS 692	Part 50 of IS 10810

24.2 Acceptance Tests

The following shall constitute acceptance tests:

- Conductor resistance test,
- Test for thickness of insulation,
- Test for thickness of lead and lead alloy sheath,
- Test for thickness of steel tape or diameter of round wires or dimensions of steel strips,
- Dielectric power factor/voltage test (for 19/33 kV cables only),
- Voltage test, and
- Test for thickness of extruded PVC bedding and serving.

24.2.1 A recommended sampling plan for acceptance tests is given in Annex D.

24.3 Routine Tests

The following shall constitute routine tests:

- Conductor resistance test,
- Dielectric power factor/voltage test (for 19/33 kV cables only), and
- Voltage test.

24.4 Optional Tests

The following shall constitute optional tests:

	<i>For Require- ments Refer to:</i>	<i>For Test Method Refer to:</i>
a) Drainage test for cables installed vertically,	24.10 of IS 692	Part 52 of IS 10810
b) Flammability test, and	24.11 of IS 692	Part 53 of IS 10810
c) Dripping test	24.12 of IS 692	Part 51 of IS 10810

24.5 Test for Thickness of Insulation

24.5.1 The measurement of the thickness of the insulation shall be made on a representative sample of the cable not more than 150 mm in length, taken not less than 300 mm from the end of a factory length.

24.5.2 Procedure

The thickness of insulation shall be determined by bunching together the individual paper tapes removed from the finished cable (without removing the surplus compound from the papers) and measuring the total thickness with dead weight dial type micrometer having the

characteristics as described in IS 10810 (Part 6) : 1984. All the tapes which make up the insulation shall be included in the measurement. When thickness of the insulation is so great that it is inconvenient to bunch all the tapes, they may be separated into as few groups as are necessary to obtain satisfactory measurement of each group. The thickness of all the groups shall be added to obtain the total thickness. The faces of the micrometer shall be cleaned between successive measurements.

24.6 Breaking Strength and Elongation Test for Insulation

This test shall be in accordance with IS 10810 (Part 8) : 1964 and when tested thus the breaking strength of the test strip shall not fall below 700 N mm of thickness and the elongation at break shall not be less than 1.5 percent.

24.7 Impulse Test

24.7.1 An impulse test as laid down in 24.7.2 may be applied as a type test for 12.7/22 kV cables and 19/33 kV cables. For 6.35/11 kV cables, this test is not required. It shall be considered sufficient if the impulse level of 75 kV is certified by the manufacturer.

24.7.2 For orders for cables of length of 5 km and above, a sample of 10 m length taken from every 6 km of the cable shall be subjected to impulse voltage test which shall be carried out at room temperature in accordance with IS 10810 (Part 47) : 1984 and no break-down of the insulation shall occur. The impulse test voltages shall be as follows:

<i>Voltage Designation</i>	<i>U_0/U</i>	<i>Impulse Test Voltage</i>
	kV	kV
	12.7/22	125
	19/33	170

24.8 Dielectric Power Factor/Voltage Test

24.8.1 This test is applicable only to 19/33 kV cables and shall be carried out before the high voltage test at room temperature in accordance with IS 10810 (Part 48) : 1984.

24.8.2 The test shall be made at 0.5 E_0 , E_0 and 2 E_0 (that is, 9.5 kV, 19 kV and 38 kV) between each conductor and screen or metallic sheath.

24.8.3 The value of power factor of dielectric loss at rated E_0 (that is, at 19 kV) and the difference in power factor between the half and rated voltage 9.5 kV and twice the rated voltage

(38 kV) shall in no case exceed the appropriate value specified below:

Type of Insulation	Maximum Power Factor at Rated Voltage (19 kV)	Maximum Difference in Power Factor Between Half Rated Voltage 9.5 kV and Twice Rated Voltage (38 kV)
For cables with normal compound	0.008	0.002 4
For cables with non-draining type compound	0.01	0.012

24.9 High Voltage Test

24.9.1 All completed cables shall be subjected to the voltage test which shall be carried out in accordance with IS 10810 (Part 45) : 1984 and no break-down of the insulation shall occur.

24.9.2 The test shall be at room temperature and the value of the applied ac test voltages shall be as given below. The voltage shall be applied and increased gradually to the specified value and shall be maintained continuously for 5 minutes between conductors and between each conductor and sheath which shall be earthed.

Test Voltage on Completed Cable at Works

Alternating Test Voltage (rms)			
Belted Cables		Single-core SL and Screened Cables	
Between Conductors	Between Conductors and sheath	Between any conductor and sheath	
(1) kV	(2) kV	(3) kV	(4) kV
0.65/1.1	3	3	3
1.1/1.1			
1.9/3.3			
3.3/3.3	9.5	5.5	5.5
3.3/6.6	9.5	9.5	9.5
6.6/6.6	17	9.8	9.8
6.6/11	17	17	17
6.35/11	25	14.4	25
11/11	25	25	17
12.7/22	—	—	30
19/33	—	—	45

24.9.3 Alternatively by agreement between the purchaser and the manufacturer, the test may be made with direct current, the applied voltage being 2.4 times the power frequency test voltage and duration of the test 5 minutes.

24.10 Drainage Test for Cables Installed Vertically

This test shall be carried out in accordance with IS 10810 (Part 52) : 1984. The maximum drainage shall not exceed 3 percent. The test sample shall be suspended vertically at the appropriate temperatures given below:

Voltage Designation kV	Type	Test Temperature °C
Up to and including 6.6/6.6	All types	80
6.35/11 and 11/11	Screened single-core and 3-core	70
6.35/11 and 11/11	Belted 3-core	65
12.7/22	All types	65
19/33	All types	65

24.11 Flammability Test (Applicable to Extruded PVC Served Cables Only)

This test shall be carried out in accordance with IS 10810 (Part 53) : 1984. Period of burning after removal of flame shall not exceed 60 seconds and the unaffected (uncharred) portion from the lower edge of the top clamp shall be at least 50 mm.

24.12 Dripping Test

This test shall be carried out in accordance with IS 10810 (Part 51) : 1984 and shall meet the following requirements:

- Where the same type of compound is used for bedding and serving, the compound shall not drip from any point, and
- Where separate grades of compounds are used for bedding and serving the compound for the serving shall not drip from any point.

24.13 Bending Test for Finished Cables

This test shall be carried out in accordance with IS 10810 (Part 50) : 1984 and shall meet the following requirements:

- The cable sample withstands the applied voltage test without failure; and
- The visual examination shows that the serving is free from splits; the armour is not noticeable disposed and the sheath is free from splits or cracks.

SECTION 5 IDENTIFICATION, PACKING AND MARKING

25 END MARKING

The ends of factory lengths of cables shall be capped and sealed with plumbing metal, the cores being suitably insulated from the cap. The caps shall be marked with letters 'A' and 'Z', 'A' being the end at which the sequence of the core numbers (see 16.2) is clockwise and 'Z' the end at which the sequence is anti-clockwise.

26 VOLTAGE IDENTIFICATION

26.1 All 3.3 kV cables and above with lapped serving shall be identified by means of galvanised steel wire of diameter 1.4 mm or alternatively a galvanised steel strip of size 0.4 × 0.8 mm applied longitudinally as follows:

- Unarmoured cables : Over the outer layer of paper in bedding
- Armoured cables : Over the armouring.

26.2 Where the cable is provided with extruded PVC serving this shall be embossed legibly with the words 'HIGH VOLTAGE'.

27 MANUFACTURER'S IDENTIFICATION

The manufacturer's name or trade mark shall be identified throughout the length of the cable by a tape under the sheath, bearing the manufacturer's name or trade mark and the year of manufacture. As an alternative, for cables with an outer sheath of PVC, the identification of the manufacturer and the year of manufacture may be by printing, indentation or embossing on the outersheath.

28 CABLE IDENTIFICATION CODE

The following code is recommended for distinguishing the type of cable required:

Constituent	Cable Letter
Aluminium conductor	A
Paper insulation	P
Lead sheath	L
Lead alloy sheath	Ly
Lapped bedding or serving of compounded fibrous material	S
Extruded PVC bedding or serving	Y
Double steel tape armour	T
Double steel tape armour galvanised	Tg

Single round steel wire armour	W
Single steel strip armour	F
Double round steel wire armour	WW
Double steel strip armour	FF

29 PACKING AND MARKING

29.1 The cable shall be wound on a drum of suitable size (see IS 10418 : 1982) packed and marked.

29.1.1 The cable shall carry the following information stencilled on the drum:

- Indication of source of manufacture,
- Type of cable and voltage grade,
- Cable code,
- Nominal cross-sectional area of the conductor,
- Number of cores,
- Length of the cable on the drum,
- Number of lengths on drum (if more than one),
- Direction of rotation of drum (by means of an arrow),
- Approximate gross mass; and
- Year of manufacture.

SECTION 6 TABLES

Table 1 Dimensions for 0.66/1.1 kV
(Earthed or Unearthed) Single-core
(Unarmoured) Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1) mm ²	(2) mm	(3) mm	(4) mm
6	1.4	1.0	1.4
10	1.4	1.0	1.4
16	1.4	1.0	1.4
25	1.4	1.0	1.4
35	1.4	1.0	1.4
50	1.4	1.0	1.4
70	1.4	1.0	1.4
95	1.4	1.0	1.4
120	1.4	1.1	1.4
150	1.4	1.1	1.4
185	1.4	1.2	1.4
240	1.7	1.3	1.4
300	1.7	1.4	1.4
400	2.0	1.5	1.4
500	2.0	1.6	1.5
630	2.3	1.7	1.6
800	2.5	1.8	1.7
1 000	2.5	2.0	1.8

**Table 2 Dimensions for 1·9/3·3 (Earthed)
Single-Core (Unarmoured) Cables**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1) mm ²	(2) mm	(3) mm	(4) mm
16	2·3	1·0	1·4
25	2·3	1·0	1·4
35	2·3	1·0	1·4
50	2·3	1·0	1·4
70	2·3	1·0	1·4
95	2·3	1·1	1·4
120	2·3	1·1	1·4
150	2·3	1·2	1·4
185	2·3	1·2	1·4
240	2·3	1·3	1·4
300	2·3	1·4	1·4
400	2·3	1·5	1·4
500	2·3	1·6	1·5
630	2·5	1·7	1·6
800	2·7	1·8	1·7
1 000	2·7	2·0	1·8

**Table 4 Dimensions for 3·8/6·6 kV
(Earthed) Single-Core
(Unarmoured) Cables**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1) mm ²	(2) mm	(3) mm	(4) mm
16	3·0	1·0	1·4
25	3·0	1·0	1·4
35	3·0	1·0	1·4
50	3·0	1·0	1·4
70	3·0	1·1	1·4
95	3·0	1·1	1·4
120	3·0	1·2	1·4
150	3·0	1·2	1·4
185	3·0	1·3	1·4
240	3·0	1·4	1·4
300	3·0	1·4	1·4
400	3·0	1·6	1·5
500	3·0	1·6	1·6
630	3·0	1·7	1·7
800	3·0	1·9	1·8
1 000	3·0	2·0	1·9

**Table 3 Dimensions for 3·3/3·3 kV
(Unearthed) Single-Core
(Unarmoured) Cables**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1) mm ²	(2) mm	(3) mm	(4) mm
16	2·8	1·0	1·4
25	2·8	1·0	1·4
35	2·8	1·0	1·4
50	2·8	1·0	1·4
70	2·8	1·1	1·4
95	2·8	1·1	1·4
120	2·8	1·2	1·4
150	2·8	1·2	1·4
185	2·8	1·3	1·4
240	2·8	1·4	1·4
300	2·8	1·4	1·4
400	2·8	1·6	1·5
500	2·8	1·6	1·5
630	2·8	1·6	1·6
800	2·8	1·8	1·7
1 000	2·8	2·0	1·9

**Table 5 Dimensions for 6·6/6·6 kV
(Unearthed) Single-Core
(Unarmoured) Cables**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1) mm ²	(2) mm	(3) mm	(4) mm
16	3·8	1·0	1·4
25	3·8	1·0	1·4
35	3·8	1·0	1·4
50	3·8	1·1	1·4
70	3·8	1·1	1·4
95	3·8	1·2	1·4
120	3·8	1·2	1·4
150	3·8	1·3	1·4
185	3·8	1·3	1·4
240	3·8	1·4	1·4
300	3·8	1·5	1·4
400	3·8	1·6	1·5
500	3·8	1·7	1·6
630	3·8	1·7	1·7
800	3·8	1·9	1·8
1 000	3·8	2·0	1·9

**Table 6 Dimensions for 6.35/11 kV
(Earthed) Single-Core
(Unarmoured) Screening Cable**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1)	(2)	(3)	(4)
mm ²	mm	mm	mm
16	3.3	1.0	1.4
25	3.3	1.0	1.4
35	3.3	1.0	1.4
50	3.3	1.1	1.4
70	3.3	1.1	1.4
95	3.3	1.2	1.4
120	3.3	1.2	1.4
150	3.3	1.3	1.4
185	3.3	1.3	1.4
240	3.3	1.4	1.4
300	3.3	1.5	1.4
400	3.3	1.6	1.5
500	3.3	1.7	1.6
630	3.3	1.8	1.7
800	3.3	1.9	1.8
1 000	3.3	2.0	1.9

NOTE — These cables may also be used for 6.6/6.6 kV system.

**Table 7 Dimensions for 11/11 kV
(Earthed) Single-Core
(Unarmoured) Screening Cable**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1)	(2)	(3)	(4)
mm ²	mm	mm	mm
25	4.6	1.1	1.4
35	4.6	1.1	1.4
50	4.6	1.1	1.4
70	4.6	1.2	1.4
95	4.6	1.3	1.4
120	4.6	1.4	1.4
150	4.6	1.3	1.4
185	4.6	1.4	1.4
240	4.6	1.5	1.4
300	4.6	1.6	1.5
400	4.6	1.7	1.6
500	4.6	1.8	1.7
630	4.6	1.9	1.7
800	4.6	2.0	1.9
1 000	4.6	2.1	2.0

**Table 8 Dimensions for 12.7/22 kV
(Earthed) Single-Core
(Unarmoured) Screening Cable**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1)	(2)	(3)	(4)
mm ²	mm	mm	mm
25	5.8	1.1	1.4
35	5.8	1.2	1.4
50	5.8	1.2	1.4
70	5.8	1.3	1.4
95	5.8	1.3	1.4
120	5.8	1.4	1.4
150	5.8	1.4	1.4
185	5.8	1.5	1.4
240	5.8	1.6	1.5
300	5.8	1.6	1.6
400	5.8	1.7	1.6
500	5.8	1.8	1.7
630	5.8	1.9	1.8
800	5.8	2.0	1.9
1 000	5.8	2.2	2.0

**Table 9 Dimensions for 19/33 kV
(Earthed) Single-Core
(Unarmoured) Screening Cable**

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded PVC Serving
(1)	(2)	(3)	(4)
mm ²	mm	mm	mm
70	8.0	1.4	1.4
95	7.6	1.4	1.4
120	7.6	1.5	1.5
150	7.1	1.5	1.5
185	7.1	1.5	1.5
240	7.1	1.6	1.6
300	7.1	1.7	1.6
400	7.1	1.8	1.7
500	7.1	1.9	1.8
630	7.1	2.0	1.9
800	7.1	2.1	2.0
1 000	7.1	2.3	2.1

Table 10 Dimensions for 0.65/1.1 kV (Earthed or Unearthed) Two-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead Alloy Sheath	Thickness or Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Sheathing	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strip Thickness	Thickness for Unarmoured Cables	Thickness for Armoured Cables	
										Type (a)
(1) mm*	(2) mm	(3) mm	(4) mm	(5) mm	(6) mm	(7) mm	(8) mm	(9) mm	(10) mm	(11) mm
6	1.8	1.4	1.0	0.8	—	1.40	—	—	1.4	1.1
10	1.8	1.4	1.0	0.8	—	1.60	—	—	1.4	1.1
16	1.8	1.4	1.0	0.8	0.5	1.60	0.8	—	1.4	1.1
25	1.8	1.4	1.0	0.8	0.5	1.60	0.8	—	1.4	1.2
35	1.8	1.4	1.0	0.8	0.5	1.60	0.8	—	1.4	1.2
50	1.8	1.4	1.1	0.8	0.5	1.60	0.8	—	1.4	1.3
70	1.8	1.4	1.1	0.8	0.5	2.0	0.8	—	1.4	1.4
95	1.8	1.4	1.2	0.9	0.5	2.0	0.8	—	1.4	1.4
120	1.8	1.4	1.3	1.0	0.5	2.0	0.8	—	1.5	1.5
150	1.8	1.4	1.3	1.0	0.5	2.0	0.8	—	1.6	1.6
185	1.8	1.4	1.4	1.1	0.5	2.0	0.8	—	1.7	1.6
240	2.0	1.7	1.6	1.2	0.8	2.50	0.8	1.4	1.8	1.8
300	2.0	1.7	1.7	1.2	0.8	2.50	0.8	1.4	1.9	1.9
400	2.3	2.0	1.9	1.4	0.8	3.15	0.8	1.4	2.1	2.1
500	2.3	2.0	1.9	1.4	0.8	3.15	0.8	1.4	2.3	2.2
630	2.5	2.3	2.1	1.6	0.8	3.15	0.8	1.4	2.5	2.3

Table 11 Dimensions for 0.65/1.1 kV (Earthed or Unearthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extended Bedding for Armoured Cables	Nominal Dimension of Armour				Extended PVC Sheathing	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
							Type (a)	Type (b)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	1.8	1.4	1.0	0.8	—	1.40	—	—	1.4	1.1
10	1.8	1.4	1.0	0.8	—	1.60	—	—	1.4	1.1
16	1.8	1.4	1.0	0.8	0.5	1.60	0.8	—	1.4	1.2
25	1.8	1.4	1.1	0.8	0.5	1.60	0.8	—	1.4	1.2
35	1.8	1.4	1.1	0.8	0.5	1.60	0.8	—	1.4	1.3
50	1.8	1.4	1.2	0.8	0.5	1.60	0.8	—	1.4	1.3
70	1.8	1.4	1.3	0.9	0.5	2.00	0.8	—	1.4	1.4
95	1.8	1.4	1.4	0.9	0.5	2.00	0.8	—	1.5	1.5
120	1.8	1.4	1.4	1.0	0.5	2.00	0.8	—	1.6	1.6
150	1.8	1.4	1.5	1.1	0.5	2.00	0.8	—	1.7	1.7
185	1.8	1.4	1.6	1.1	0.8	2.50	0.8	1.4	1.8	1.9
240	2.0	1.7	1.8	1.2	0.8	2.50	0.8	1.4	1.9	2.0
300	2.0	1.7	1.9	1.3	0.8	2.50	0.8	1.4	2.0	2.2
400	2.3	2.0	2.1	1.4	0.8	3.15	0.8	1.4	2.3	2.3
500	2.3	2.0	2.2	1.5	0.8	3.15	0.8	1.4	2.4	2.3
630	2.5	2.3	2.4	1.7	0.8	4.0	0.8	1.4	2.7	2.5

Table 12 Dimensions for 0.65/1.1 kV (Earthed or Unearthed) Three-and-a-half Core Cables

Nominal Cross Section		Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cable*	Nominal Dimensions of Armour				Extruded PVC Serving		
Main	Neutral	Between Conductors	Between Conductors and Sheath			Steel Type Thickness	Round Steel Wire Diameter	Steel Strip Thickness	Type (a)	Type (b)	Thickness for Unarmoured Cables	Thickness for Armoured Cables
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		(11)	(12)
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
25	16	1.8	1.4	1.1	0.8	0.5	1.6	0.8	—	—	1.4	1.2
35	16	1.8	1.4	1.2	0.8	0.5	1.6	0.8	—	—	1.4	1.3
50	25	1.8	1.4	1.3	0.8	0.5	2.0	0.8	—	—	1.4	1.4
70	35	1.8	1.4	1.3	0.9	0.5	2.0	0.8	—	—	1.4	1.4
95	50	1.8	1.4	1.4	1.0	0.5	2.0	0.8	—	—	1.5	1.5
120	70	1.8	1.4	1.5	1.0	0.5	2.0	0.8	—	—	1.6	1.6
150	70	1.8	1.4	1.6	1.1	0.5	2.0	0.8	—	—	1.7	1.7
185	95	1.8	1.4	1.7	1.1	0.8	2.5	0.8	1.4	1.4	1.8	1.8
240	120	2.0	1.7	1.9	1.2	0.8	2.5	0.8	1.4	1.4	2.0	1.9
300	150	2.0	1.7	1.9	1.3	0.8	2.5	0.8	1.4	1.4	2.1	2.0
400	185	2.3	2.0	2.2	1.5	0.8	3.15	0.8	1.4	1.4	2.3	2.2
500	240	2.3	2.0	2.6	1.6	0.8	3.15	0.8	1.4	1.4	2.5	2.3
630	300	2.5	2.3	2.5	1.7	0.8	4.0	0.8	1.4	1.4	2.7	2.5

Table 13 Dimensions for 0.65/1.1 kV (Earthed or Unearthed) Four-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Sheathing	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strip Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
							Type (a)	Type (b)		
(1) mm ²	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6	18	14	10	0.8	—	1.6	—	—	1.4	1.1
10	18	14	10	0.8	0.5	1.6	0.8	—	1.4	1.2
16	18	14	11	0.8	0.5	1.6	0.8	—	1.4	1.2
25	18	14	11	0.8	0.5	1.6	0.8	—	1.4	1.3
35	18	14	12	0.8	0.5	1.6	0.8	—	1.4	1.3
50	18	14	13	0.9	0.5	2.0	0.8	—	1.4	1.4
70	18	14	14	0.9	0.5	2.0	0.8	—	1.5	1.5
95	18	14	15	1.0	0.5	2.0	0.8	—	1.6	1.6
120	18	14	16	1.1	0.5	2.0	0.8	—	1.7	1.7
150	18	14	16	1.1	0.8	2.5	0.8	1.4	1.8	1.8
185	18	14	18	1.2	0.8	2.5	0.8	1.4	1.9	1.8
240	20	17	20	1.3	0.8	2.5	0.8	1.4	2.1	2.0
300	20	17	21	1.4	0.8	3.15	0.8	1.4	2.2	2.1
400	23	20	24	1.5	0.8	3.15	0.8	1.4	2.5	2.3
500	23	20	24	1.7	0.8	4.0	0.8	1.4	2.6	2.5
630	25	23	27	1.8	0.8	4.0	0.8	1.4	2.9	2.7

Table 14 Dimensions for 1.9/3.3 kV (Earthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Serving	
	Between Conductors	Between Conductor and Sheath			Steel Type Thickness	Round Steel Wire Diameter	Steel Strip Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
							Type (a)	Type (b)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm ^a	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
16	2.8	2.3	1.1	0.8	0.5	1.6	0.4	—	1.4	1.2
25	2.8	2.3	1.1	0.8	0.5	1.6	0.8	—	1.4	1.3
35	2.8	2.3	1.1	0.8	0.5	1.6	0.8	—	1.4	1.3
50	2.8	2.3	1.3	0.9	0.5	2.0	0.8	—	1.4	1.4
70	2.8	2.3	1.4	0.9	0.5	2.0	0.8	—	1.5	1.5
95	2.8	2.3	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6
120	2.8	2.3	1.5	1.0	0.5	2.0	0.8	—	1.7	1.7
150	2.8	2.3	1.6	1.1	0.8	2.5	0.8	1.4	1.7	1.8
185	2.8	2.3	1.7	1.2	0.8	2.5	0.8	1.4	1.8	1.9
240	2.8	2.3	1.9	1.2	0.8	2.5	0.8	1.4	2.0	2.0
300	2.8	2.3	2.0	1.3	0.8	2.5	0.8	1.4	2.1	2.2
400	2.8	2.3	2.2	1.4	0.8	3.15	0.8	1.4	2.3	2.3
500	2.8	2.3	2.3	1.5	0.8	3.15	0.8	1.4	2.5	2.5
630	2.8	2.3	2.5	1.7	0.8	4.0	0.8	1.4	2.7	2.5

Table 15 Dimensions for 3.3/3.3 kV (Unearthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extra- ded Bedding for Armoured Cables	Nominal Dimensions of Armour						Extruded PVC Serving	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strip Thickness	Tape		Thickness for Unarmoured Cables	Thickness for Armoured Cables	
								(a)	(b)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
16	2.8	2.8	1.1	0.8	0.5	1.6	0.8	—	1.4	1.3	1.3	
25	2.8	2.8	1.1	0.8	0.5	1.6	0.8	—	1.4	1.3	1.3	
35	2.8	2.8	1.2	0.8	0.5	2.0	0.8	—	1.4	1.4	1.4	
50	2.8	2.8	1.3	0.9	0.5	2.0	0.8	—	1.4	1.4	1.4	
70	2.8	2.8	1.4	1.0	0.5	2.0	0.8	—	1.5	1.5	1.5	
95	2.8	2.8	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6	1.6	
120	2.8	2.8	1.5	1.1	0.5	2.0	0.8	—	1.7	1.7	1.7	
150	2.8	2.8	1.6	1.1	0.8	2.5	0.8	1.4	1.8	1.8	1.8	
185	2.8	2.8	1.7	1.2	0.8	2.5	0.8	1.4	1.9	1.9	1.9	
240	2.8	2.8	1.8	1.3	0.8	2.5	0.8	1.4	2.0	2.0	2.0	
300	2.8	2.8	2.0	1.3	0.8	2.5	0.8	1.4	2.1	2.1	2.1	
400	2.8	2.8	2.2	1.5	0.8	3.15	0.8	1.4	2.3	2.3	2.3	
500	2.8	2.8	2.3	1.6	0.8	3.15	0.8	1.4	2.5	2.5	2.5	
630	2.8	2.8	2.5	1.7	0.8	4.0	0.8	1.4	2.7	2.7	2.7	

Table 16 Dimensions for 3.8/6.6 kV (Earthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead Alloy Sheath	Thickness of Extra- ded Bedding for Armoured Cables	Nominal Dimensions of Armour			Steel Strip Thickness		Thickness for Unarmoured Cables		Thickness for Armoured Cables
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Type (a)	Type (b)	(10)			
										(8)	(9)	
(1) mm ^a	(2) mm	(3) mm	(4) mm	(5) mm	(6) mm	(7) mm	(8) mm	(9) mm	(10) mm	(11) mm		
16	3.8	3.0	1.2	0.8	0.5	1.6	0.8	—	1.4	1.3		
25	3.8	3.0	1.2	0.8	0.5	1.6	0.8	—	1.4	1.3		
35	3.8	3.0	1.3	0.9	0.5	2.0	0.8	—	1.4	1.4		
50	3.8	3.0	1.3	0.9	0.5	2.0	0.8	—	1.4	1.5		
70	3.8	3.0	1.5	1.0	0.5	2.0	0.8	—	1.5	1.5		
95	3.8	3.0	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6		
120	3.8	3.0	1.6	1.1	0.8	2.5	0.8	1.4	1.7	1.7		
150	3.8	3.0	1.7	1.1	0.8	2.5	0.8	1.4	1.8	1.8		
185	3.8	3.0	1.8	1.2	0.8	2.5	0.8	1.4	1.9	1.9		
240	3.8	3.0	2.0	1.3	0.8	2.5	0.8	1.4	2.1	2.0		
300	3.8	3.0	2.0	1.4	0.8	3.15	0.8	1.4	2.2	2.1		
400	3.8	3.0	2.2	1.5	0.8	3.15	0.8	1.4	2.4	2.2		
500	3.8	3.0	2.4	1.6	0.8	3.15	0.8	1.4	2.5	2.4		
630	3.8	3.0	2.5	1.7	0.8	4.0	0.8	1.4	2.7	2.5		

Table 17 Dimensions for 6-6/6-6 kV (Unearthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimension of Armour					Extruded PVC Serving	
	(2) mm	(3) mm			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness	Type		Thickness for Unarmoured Cables (10) mm	Thickness for Armoured Cables (11) mm
								(a) mm	(b) mm		
(1) mm ²			(4) mm	(5) mm	(6) mm	(7) mm	(8) mm	(9) mm			
16	3.8	3.8	1.3	0.8	0.5	1.6	0.8	—	1.4	1.3	
25	3.8	3.8	1.3	0.9	0.5	2.0	0.8	—	1.4	1.4	
35	3.8	3.8	1.3	0.9	0.5	2.0	0.8	—	1.5	1.5	
50	3.8	3.8	1.4	1.0	0.5	2.0	0.8	—	1.6	1.6	
70	3.8	3.8	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6	
95	3.8	3.8	1.6	1.1	0.5	2.0	0.8	—	1.7	1.7	
120	3.8	3.8	1.7	1.1	0.8	2.5	0.8	1.4	1.8	1.8	
150	3.8	3.8	1.7	1.2	0.8	2.5	0.8	1.4	1.9	1.8	
185	3.8	3.8	1.8	1.2	0.8	2.5	0.8	1.4	2.0	1.9	
240	3.8	3.8	2.0	1.3	0.8	2.5	0.8	1.4	2.1	2.0	
300	3.8	3.8	2.1	1.4	0.8	3.15	0.8	1.4	2.2	2.1	
400	3.8	3.8	2.3	1.5	0.8	3.15	0.8	1.4	2.4	2.3	
500	3.8	3.8	2.4	1.6	0.8	4.0	0.8	1.4	2.6	2.4	
630	3.8	3.8	2.6	1.7	0.8	4.0	0.8	1.4	2.8	2.6	

Table 18 Dimensions for 6.35/11 kV (Earthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extra- added Bedding for Armoured Cables	Nominal Dimension of Armour				Extruded PVC Serving	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
							Type (a)	Type (b)		
(1) mm ^a	(2) mm	(3) mm	(4) mm	(5) mm	(6) mm	(7) mm	(8) mm	(9) mm	(10) mm	(11) mm
16	5.3	3.8	1.3	0.8	0.5	2.0	0.8	—	1.4	1.4
25	5.3	3.8	1.3	0.9	0.5	2.0	0.8	—	1.4	1.4
35	5.3	3.8	1.4	0.9	0.5	2.0	0.8	—	1.5	1.5
50	5.3	3.8	1.5	1.0	0.5	2.0	0.8	—	1.5	1.5
70	5.3	3.8	1.6	1.0	0.5	2.0	0.8	—	1.6	1.6
95	5.3	3.8	1.8	1.1	0.8	2.5	0.8	1.4	1.7	1.7
120	5.3	3.8	1.8	1.2	0.8	2.5	0.8	1.4	1.8	1.8
150	5.3	3.8	1.8	1.2	0.8	2.5	0.8	1.4	1.9	1.9
185	5.3	3.8	1.9	1.3	0.8	2.5	0.8	1.4	2.0	2.0
240	5.3	3.8	2.1	1.4	0.8	3.15	0.8	1.4	2.1	2.1
300	5.3	3.8	2.2	1.4	0.8	3.15	0.8	1.4	2.3	2.3
400	5.3	3.8	2.4	1.6	0.8	3.15	0.8	1.4	2.5	2.5
500	5.3	3.8	2.6	1.7	0.8	4.0	0.8	1.4	2.3	2.3
630	5.3	3.8	2.6	1.8	0.8	4.0	0.8	1.4	2.8	2.8

Table 19 Dimensions for 11/11 kV (Unearthed) Three-Core Belted Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extra ded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Serving	
	Between Conductors	Between Conductor and Sheath			Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
							Type (a)	Type (b)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
16	5.3	5.3	1.4	0.9	0.5	2.0	0.8	—	1.4	1.4
25	5.3	5.3	1.4	0.9	0.5	2.0	0.8	—	1.5	1.5
35	5.3	5.3	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6
50	5.3	5.3	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6
70	5.3	5.3	1.7	1.1	0.8	2.5	0.8	1.4	1.7	1.7
95	5.3	5.3	1.7	1.2	0.8	2.5	0.8	1.4	1.8	1.8
120	5.3	5.3	1.8	1.2	0.8	2.5	0.8	1.4	1.9	1.9
150	5.3	5.3	1.9	1.3	0.8	2.5	0.8	1.4	2.0	2.0
185	5.3	5.3	2.0	1.3	0.8	2.5	0.8	1.4	2.1	2.1
240	5.3	5.3	2.2	1.4	0.8	3.15	0.8	1.4	2.2	2.1
300	5.3	5.3	2.2	1.5	0.8	3.15	0.8	1.4	2.2	2.1
400	5.3	5.3	2.5	1.6	0.8	4.0	0.8	1.4	2.4	2.2
500	5.3	5.3	2.7	1.7	0.8	4.0	0.8	1.4	2.6	2.4
630	5.3	5.3	2.7	1.8	0.8	4.0	0.8	1.4	2.7	2.5
									2.9	2.7

Table 20 Dimensions for 6.35/11 kV (Earthed) Three-Core Screened Cables

Nominal Cross Section	Thickness of Insulation		Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour					Extruded PVC Serving	
	Between Conductors	Between Conductor and Sheath			Steel Type Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables	
							Type (a)	Type (b)			
(1) mm ^a	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
16	3.3	3.3	1.4	0.9	mm	mm	mm	mm	mm	mm	
25	3.3	3.3	1.4	0.9	0.5	2.0	0.8	—	1.4	1.4	
35	3.3	3.3	1.5	0.9	0.5	2.0	0.8	—	1.4	1.4	
50	3.3	3.3	1.5	1.0	0.5	2.0	0.8	—	1.5	1.5	
70	3.3	3.3	1.5	1.0	0.5	2.0	0.8	—	1.6	1.6	
95	3.3	3.3	1.7	1.1	0.8	2.5	0.8	1.4	1.7	1.7	
120	3.3	3.3	1.8	1.2	0.8	2.5	0.8	1.4	1.8	1.8	
150	3.3	3.3	1.9	1.2	0.8	2.5	0.8	1.4	1.9	1.9	
185	3.3	3.3	2.0	1.3	0.8	2.5	0.8	1.4	2.0	2.0	
240	3.3	3.3	2.1	1.4	0.8	3.15	0.8	1.4	2.2	2.1	
300	3.3	3.3	2.2	1.4	0.8	3.15	0.8	1.4	2.3	2.2	
400	3.3	3.3	2.4	1.6	0.8	3.15	0.8	1.4	2.5	2.3	

Table 21 Dimensions for 11/11 kV (Unearthed) Three-Core Screened Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour			Extruded PVC Serving		
				Steel Type Thickness	Round Steel Wire Diameter	Steel Strips Thickness	Thickness for Unarmoured- Armoured red Cables		
							Type (a)	Type (b)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
mm ^a	mm	mm	mm	mm	mm	mm	mm	mm	mm
16	4.6	1.6	1.0	0.5	2.0	0.8	—	1.5	1.5
25	4.6	1.6	1.0	0.5	2.0	0.8	—	1.6	1.6
35	4.6	1.6	1.0	0.5	2.0	0.8	—	1.6	1.6
50	4.6	1.7	1.1	0.8	2.5	0.8	1.4	1.7	1.7
70	4.6	1.8	1.1	0.8	2.5	0.8	1.4	1.8	1.8
95	4.6	1.9	1.2	0.8	2.5	0.8	1.4	1.9	1.9
120	4.6	2.0	1.3	0.8	2.5	0.8	1.4	2.0	2.0
150	4.6	2.1	1.3	0.8	2.5	0.8	1.4	2.1	2.1
185	4.6	2.1	1.4	0.8	3.15	0.8	1.4	2.2	2.2
240	4.6	2.2	1.5	0.8	3.15	0.8	1.4	2.3	2.3
300	4.6	2.4	1.5	0.8	3.15	0.8	1.4	2.5	2.5
400	4.6	2.6	1.7	0.8	4.0	0.8	1.4	2.7	2.7

Table 22 Dimensions for 12·7/22 kV (Earthed) Three-Core Screened Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extra- ded Bedding for Armoured Cables	Nominal Dimensions of Armour						Extruded PVC Serving	
				Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness	Type		Thickness for Unarmoured Cables	Thickness for Armoured Cables	
							(a)	(b)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm		
25	5·8	1·8	1·1	0·8	2·5	0·8	1·4	1·7	1·7		
35	5·8	1·8	1·1	0·8	2·5	0·8	1·4	1·8	1·8		
50	5·8	1·9	1·2	0·8	2·5	0·8	1·4	1·9	1·8		
70	5·8	2·0	1·2	0·8	2·5	0·8	1·4	2·0	1·9		
95	5·8	2·0	1·3	0·8	2·5	0·8	1·4	2·1	2·0		
120	5·8	2·2	1·4	0·8	3·15	0·8	1·4	2·2	2·1		
150	5·8	2·2	1·4	0·8	3·15	0·8	1·4	2·3	2·1		
185	5·8	2·3	1·5	0·8	3·15	0·8	1·4	2·4	2·2		
240	5·8	2·5	1·6	0·8	3·15	0·8	1·4	2·5	2·3		
300	5·8	2·6	1·6	0·8	4·0	0·8	1·4	2·6	2·4		
400	5·8	2·8	1·8	0·8	4·0	0·8	1·4	2·8	2·6		

Table 23 Dimensions for 19/33 kV (Earthed) Three-Core Screened Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Serving	
				Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
						Type (a)	Type (b)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
mm ²	mm	mm	mm	mm	mm	mm	mm	mm	mm
70	8.0	2.3	1.4	0.8	3.15	0.8	1.4	2.3	2.1
95	7.6	2.3	1.4	0.8	3.15	0.8	1.4	2.3	2.2
120	7.6	2.4	1.5	0.8	3.15	0.8	1.4	2.4	2.3
150	7.1	2.4	1.5	0.8	3.15	0.8	1.4	2.4	2.3
185	7.1	2.5	1.6	0.8	3.15	0.8	1.4	2.5	2.4
240	7.1	2.7	1.7	0.8	4.0	0.8	1.4	2.7	2.5
300	7.1	2.7	1.7	0.8	4.0	0.8	1.4	2.8	2.6
400	7.1	2.8	1.9	0.8	4.0	0.8	1.4	3.0	2.7

Table 24 Dimensions for 12·4/22 kV (Earthed) Three-Core Screened SL Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead Alloy Sheath	Thickness of Extra- ded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Serving	
				Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
						Type (a)	Type (b)		
(1) mm ^a	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
25	5·8	1·1	0·8	0·8	2·5	0·8	1·4	1·9	1·8
35	5·8	1·2	0·8	0·8	2·5	0·8	1·4	1·9	1·8
50	5·8	1·2	0·8	0·8	2·5	0·8	1·4	2·0	1·9
70	5·8	1·3	0·8	0·8	2·5	0·8	1·4	2·2	2·0
95	5·8	1·3	0·8	0·8	3·15	0·8	1·4	2·2	2·0
120	5·8	1·4	0·9	0·8	3·15	0·8	1·4	2·3	2·1
150	5·8	1·4	0·9	0·8	3·15	0·8	1·4	2·4	2·2
185	5·8	1·5	0·9	0·8	3·15	0·8	1·4	2·5	2·3
240	5·8	1·6	1·0	0·8	4·0	0·8	1·4	2·6	2·4
300	5·8	1·6	1·0	0·8	4·0	0·8	1·4	2·8	2·5
400	5·8	1·7	1·0	0·8	4·0	0·8	1·4	3·0	2·6

Table 25 Dimensions for 19/33 kV (Earthed) Three-Core Screened SL Cables

Nominal Cross Section	Thickness of Insulation	Thickness of Lead or Lead-Alloy Sheath	Thickness of Extruded Bedding for Armoured Cables	Nominal Dimensions of Armour				Extruded PVC Serving	
				Steel Tape Thickness	Round Steel Wire Diameter	Steel Strips Thickness		Thickness for Unarmoured Cables	Thickness for Armoured Cables
						Type (a)	Type (b)		
(1) mm ²	(2) mm	(3) mm	(4) mm	(5) mm	(6) mm	(7) mm	(8) mm	(9) mm	(10) mm
70	8.0	1.4	0.9	0.8	3.15	0.8	1.4	2.4	2.2
95	7.6	1.4	0.9	0.8	3.15	0.8	1.4	2.5	2.2
120	7.6	1.5	0.9	0.8	3.15	0.8	1.4	2.5	2.3
150	7.1	1.5	0.9	0.8	4.0	0.8	1.4	2.6	2.3
185	7.1	1.5	1.0	0.8	4.0	0.8	1.4	2.7	2.4
240	7.1	1.6	1.0	0.8	4.0	0.8	1.4	2.8	2.5
300	7.1	1	1.0	0.8	4.0	0.8	1.4	2.9	2.6
400	7.1	1.8	1.1	0.8	4.0	0.8	1.4	3.2	2.8

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
1885 (Part 32) : 1971	Electrotechnical vocabulary: Part 32 Cables, conductors and accessories for electricity supply	(Part 7) : 1984	Tensile strength and elongation at break of thermoplastic and elastomeric insulation and sheath
3975 : 1988	Mild steel wires, formed wires and tapes for armouring of cables (<i>third revision</i>)	(Part 8) : 1984	Breaking strength and elongation at break for impregnated paper insulation
4905 : 1968	Method for random sampling	(Part 10) : 1984	Loss of mass test
5831 : 1984	PVC insulation and sheath of electric cables (<i>first revision</i>)	(Part 12) : 1984	Shrinkage test
8130 : 1984	Conductors for insulated electric cables and flexible cords (<i>first revision</i>)	(Part 15) : 1984	Hot deformation test
10418 : 1982	Drums for electric cables	(Part 24) : 1984	Water soluble impurities test of insulating paper
10810	Methods of test for cables:	(Part 25) : 1984	Conductivity of water extract test of insulating paper
(Part 1) : 1984	Annealing test for wires used in conductors	(Part 26) : 1984	pH value of water extract test of insulating paper
(Part 2) : 1984	Tensile test for aluminium wires	(Part 27) : 1984	Ash content test of insulating paper
(Part 3) : 1984	Wrapping test for aluminium wires	(Part 34) : 1984	Measurement of thickness of metallic sheath
(Part 5) : 1984	Conductor resistance test	(Part 36) : 1984	Dimensions of armouring material
(Part 6) : 1984	Thickness of thermoplastic and elastomeric insulation and sheath	(Part 45) : 1984	High voltage test
		(Part 47) : 1984	Impulse test
		(Part 48) : 1984	Dielectric power factor test
		(Part 50) : 1984	Bending test
		(Part 51) : 1984	Dripping test
		(Part 52) : 1984	Drainage test
		(Part 53) : 1984	Flammability test

ANNEX B

(Clause 5.2)

CHEMICAL CHARACTERISTICS OF INSULATION PAPER

B-1 Chemical characteristics of insulating paper shall be as given below:

<i>Characteristics</i>	<i>Requirement</i>	<i>For Test Methods, Ref Part No. of IS 10810</i>
Water soluble impurities	1.0 percent, <i>Max</i>	24
Conductivity of water extract	100 μ S/cm, <i>Max</i>	25
pH value of water extract	6.5 to 8.0	26
Ash content	1.5 percent, <i>Max</i>	27

ANNEX C

(Clause 10.4)

COMPOSITION OF LEAD AND LEAD-ALLOY SHEATH

Material	Description	Composition (Percentage by Mass)										
		Antimony		Tin		Tellurium Max	Silver Max	Copper Max	Bismuth Max	Zinc Max	Total Other Elements Max	Lead Min
		Min	Max	Min	Max							
(1) Lead	(2) Lead	(3) —	(4) 0.15	(5) —	(6) 0.1	(7) 0.005	(8) 0.005	(9) 0.06	(10) 0.05	(11) 0.002	(12) 0.01	(13) 99.8
Alloy B	0.85 percent antimony	0.80	0.95	—	0.01	0.005	0.005	0.06	0.05	0.002	0.01	Remainder
Alloy E	0.4 percent tin, 0.2 per- cent antimony	0.15	0.25	0.35	0.45	0.005	0.005	0.06	0.05	0.002	0.01	Remainder

IS 692 : 1994

ANNEX D
(Clause 24.2.1)

SAMPLING OF CABLES

D-1 LOT

D-1.1 In any consignment, the cables of the same size manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

D-2 SCALE OF SAMPLING

D-2.1 Samples shall be taken and tested from each lot for ascertaining the conformity of the lot to the requirements of the specification.

D-2.2 The number of samples to be selected shall depend on col 1 and 2 as indicated below. The samples shall be taken at random.

<i>Number of Drums in the Lot</i>	<i>Number of Drums to be Taken as Sample</i>	<i>Permissible Number of Defectives</i>
(1) <i>N</i>	(2) <i>n</i>	(3) <i>a</i>
Up to 50	2	0
51 to 100	5	0
101 to 300	13	0
301 to 500	20	1
501 and above	32	2

D-2.2.1 In order to ensure the randomness of selection, random number tables shall be used (IS 4905 : 1968).

D-3 NUMBER OF TESTS AND CRITERION FOR CONFORMITY

D-3.1 Suitable lengths of test samples shall be taken from each of the drum selected. These test samples shall be subjected to each of the acceptance tests (24.2). A test sample is called defective if it fails in any one of the acceptance tests. If the number of defective is less than or equal to the corresponding permissible number given in col 3, under **D-2.2** the lot shall be declared as conforming to the requirements of acceptance tests; otherwise not.

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Power Cables Sectional Committee, ETD 9

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was originally published in 1957 and subsequently revised in 1965 and 1973. This third revision has been brought out to take into account the experience gained during this period in the manufacture of these types of cables in the country and to bring this standard in line with international practice to the extent considered appropriate.

The correct type of cables should be selected for the system keeping in view whether the system is earthed or unearthed.

It should be realised that in an electric system where an earth fault is not automatically and promptly eliminated, the extra stresses on the insulation of the cable during the earth fault reduce the life of cable to a certain extent. Therefore, if the system is expected to be operated quite often with a prolonged earth fault, it is necessary to select the cables suitable for unearthed system.

In preparing this standard, assistance has been derived from IEC Publications 55-1 (1978) and 55-2 (1981) 'Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV : Part 1 Tests and Part 2 General and constructional requirements', issued by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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